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ABSTRACT

This paper begins by emphasizing the school counselor's role in insuring equal educational opportunities for all students. The problem of girls' low enrollment in secondary school mathematics classes and the implications of an inadequate mathematics background are discussed. Specific steps to encourage young women to continue their study of mathematics are identified. (DT)

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THE POWER OF THE RAISED EYEBROW

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SE 022 161

The Power of the Raised Eyebrow

There is a tide in the affairs of men,
Which, taken at the flood, leads on to fortune;
Omitted, all the voyage of their life
Is bound in shallows and in miseries.

William Shakespeare
Julius Caesar, Act IV, Scene 3.

And there is a tide in the academic counseling of a young woman which, taken at the flood, leads on to the discovery of a new world of ideas, and which ignored or denied, destines her to choose among a much-limited range of career choices and to feel inadequate in her ability to deal with a large portion of the world's accumulated knowledge.

Sex discrimination in educational institutions receiving federal funds was prohibited by the Educational Amendments of 1972. The counselor has a very real part to play in discovering and correcting those school policies and practices which discriminate on the basis of sex. (See Figure 1). The counselor's role in ensuring equal educational opportunities for all students, however, goes beyond merely assisting school administrators meet the requirements of the Title IX regulations. Full legal compliance can be circumvented by the subtle messages sent to their student clients by guidance personnel. The counselor's spoken or implied approval, or lack of approval, is especially powerful in the area of mathematics.

It is common knowledge that in the elementary school, girls perform at least as well as boys in all subjects, including mathematics.[1] At the junior high school level, there are about as many girls as boys in the Algebra I classes. By the time the senior year rolls around, the ratio of males to females in advanced mathematics courses approaches 3 to 1. And by the third semester of mathematics in college, the ratio falls to about 6 to 1.[2] Are young women naturally unsuited to the study of mathematics? Is there something innate which predisposes those of the female sex to forsake the rigors of mathematics in the adolescent years? Or is there some other reason why even the brightest young women fail to take the very courses which would open a wide range of options to them on the college level? And what is the role of the secondary school counselor in all this?

There is, it has been shown, a small proportion of mathematically-related ability which is attributable to genetic factors.[3] The remaining, much larger, porportion is subject to environmental influence. One would like, as suggested by the King of Hearts in Alice in Wonderland, to begin at the beginning with the story of how environmental pressures upon male children and female children affect their career choices but such a saga is not only too lengthy for consideration here but, given the scope of appropriate activities for the secondary school guidance counselor, would serve no immediate purpose. Material on sex-role socialization is readily available in literature.[4] These influences are extremely powerful and their effects are observable in high-school aged women

who regard their lack of skill at mathematics as a positive social grace.[5]

Given that this is so, why should the overly-busy counselor take time to bother fighting society on this score? Aren't there many other skills and abilities which are as important as mathematics in the ongoing ascent of man? Well, yes, there are; but lack of knowledge of this particular subject affects many of those other areas of knowledge and closes many doors of which young people are not even aware. Without three years of high school mathematics a majority of the academic majors at most institutions are closed to college students. Perhaps the reader of this paper is one of those who avoided, with greater or lesser success, the study of mathematics throughout most of a high school and college career only to find that for a master's in counseling, statistics courses were required. If this is indeed the case, I need not elaborate on the ways that an adequate and confidence-inducing background in the way numbers work can reduce tension.

An inadequate mathematical background can hurt both male and female students, of course, but the world we know is such that the majority of those who fail to take enough mathematics courses in high school are female. (Female students are the majority of those bright students who fail to go on to college, comprising 75 to 90% of that population.)[6]

The study of mathematics, for reasons which have been lost in the mists of antiquity, is an endeavor which has been decreed masculine. It is hard to rationalize why this should have happened because the tools of a mathematician,

unlike those of the draftsman or surgeon, do not demand an outstanding skill in spatial ability, and, certainly unlike the tools of the bricklayer or the geologist, are not of excessive weight. They are, indeed, exactly like the tools of the school teacher or the secretary -- books, pencils and paper. And the mental equipment required is essentially the same as required for the poet -- a creative and analytical mind. Yet in most countries of the world, mathematics wears a masculine brand.[7] Ask any high school student.

The results of belief in this stereotype are tragic. Lack of preparation in mathematics on the secondary level effectively bars young women from many of the most lucrative and satisfying careers. It limits the choice of college-bound women as to academic majors. It reinforces the notion, in each individual woman, that mathematics is an esoteric science which she is incapable of understanding and is unable to confidently apply in even the most mundane of situations.

Mathematics educators, in their attempts to remedy this situation, hope to utilize the valuable services of guidance personnel. The National Council of Teachers of Mathematics has recently published a statement on the role of the counselor with respect to mathematics at the secondary level. (See Figure 2.) Specific steps, effective in encouraging young women to continue their study of mathematics, have also been identified. Some ways counselors can increase the probability that their female students will enroll in nonrequired mathematics courses are to provide good role models, to inform students of

the career relevance of mathematics, to help students overcome math anxiety, and to be supportive of even the most tentative interest in taking a mathematics course.

Role models are powerful influences on the way people behave. Even in audio-visual presentations, the presence of female role models has a positive effect on young women viewers.[9] Young women who aspire to the study of mathematics see precious few role models among teachers in the ordinary high school, in textbooks, or in literature on the history of mathematics.[10] To counteract the existing situation, a concerted effort must be made to expose these young women to successful professional women mathematicians and to women who use mathematics in their careers. The "Queen Bee" Syndrome notwithstanding, such professionals are often pleased to have the chance to encourage others into careers that they, themselves, have found satisfying. Lecturers for science assemblies do not <u>have</u> to be men, or even more devastating, do not have to be introduced as curiosities: "Here is a <u>woman</u> chemist!"

It has been shown that male high school students believe that mathematics will have career relevance. Female high school students are not as convinced that this is the case.[11] Supplying literature on mathematics-dependent careers and speaking in the mathematics classrooms on careers for which that subject is essential are two positive, yet not unduly time-consuming, steps that secondary school counselors could take. It might be worth noting that the fields of computer programming and statistics are the least stereotyped of the mathematical sciences.

Since those who choose scientific careers have usually crystallized their choices before the age of 14,[12] counselors in the junior high schools should not leave career counseling to their colleagues in the senior high school. In addition, the scores of young women on attitude inventories should be interpreted with care. What might be a low interest score in "curiosity" or "interest in technology" for a male student may signal high interest in a female student.[13]

Many young (and older) women (and men) suffer such a fear of mathematics that they are all but paralyzed when confronted with even the simplest of mathematical situations.[14] Discussion groups which allow students to explore these fears and make progress toward conquering them in nonthreatening situations would be a valuable addition to the roster of high school co-curricular activities and/or minicourses. One need not be a mathematician to lead such a group, only a professional trained in providing support for group interaction on sensitive issues. Certainly secondary school guidance personnel fit that description.

Finally, and most pertinent to the title of this essay, those who help students decide on courses should encourage, urge, inspire, prompt, reprompt in the face of rejection, motivate, entice, all-but-force, female secondary school students to take courses in mathematics and the sciences throughout their high school careers. And, when a courageous young woman presents a course card on which she has entered mathematics as a desired course, a counselor should beam and congratulate her and <u>never</u>, <u>never</u>, raise an eyebrow!

Guidance/Counseling Statement -for Both Counselors and Mathematics Teachers at the Secondary School Level

Today, more than ever before, the study and appreciation of mathematics are vital to the intellectual development and to the scientific, industrial, technological, and social progress of society. It is essential that teachers, counselors, supervisors, educational administrators, parents, and the general public work together to provide the best mathematics education possible for all students, regardless of sex, ethnic group, national origin, or ability. All students should be encouraged to keep options open by studying mathematics so as to make maximum use of their talents. Specifically, it is suggested that students include a maximum of mathematics appropriate to their abilities and interest in their high school programs.

The educational, vocational, personal-social choices and decisions made by students should lead to satisfying and worthwhile lives. The important members of the guidance team in each school, both the school counselor and the mathematics teacher, are responsible for helping students gain insight and understanding of themselves and their environment in this decision making. Therefore, they must work cooperatively in:

1. Planning mathematics programs for individual students.
2. Placing students in mathematics courses appropriate to their needs and abilities.
3. Anticipating developments in mathematics and fields that utilize mathematics.
4. Conferring with the school administration with regard to mathematics course offerings.
5. Planning a mathematics program designed for a specific field.
6. Securing, evaluating, and making available to students a variety of career publications.
7. Planning career-oriented activities.
8. Keeping students informed about:
   a. secondary school and college mathematics programs
   b. vocational and technical school mathematics requirements
   c. college entrance requirements in mathematics
   d. mathematics requirements for majoring in specific areas
   e. procedures for obtaining college credit for mathematics courses taken in high school
   f. career opportunities in mathematics
   g. mathematics needed for specific fields and professions

Figure 2. NCTM Statement on Counseling and Guidance, May, 1976.

86.36 Counseling and use of appraisal and counseling materials.

(a) Counseling. A recipient shall not discriminate against any person on the basis of sex in the counseling or guidance of students or applicants for admission.

(b) Use of appraisal and counseling materials. A recipient which uses testing or other materials for appraising or counseling students shall not use different materials for students on the basis of their sex or use materials which permit or require different treatment of students on such basis unless such different materials cover the same occupations and interest areas and the use of such different materials is shown to be essential to eliminate sex bias. Recipients shall develop and use internal procedures for ensuring that such materials do not discriminate on the basis of sex. Where the use of a counseling test or other instrument results in a substantially disproportionate number of members of one sex in any particular course of study or classification, the recipient shall take such action as is necessary to assure itself that such disproportion is not the result of discrimination in the instrument or its application.

(c) Disproportion in classes. Where a recipient finds that a particular class contains a substantially disproportionate number of individuals of one sex, the recipient shall take such action as is necessary to assure itself that such disproportion is not the result of discrimination on the basis of sex in counseling or appraisal materials or by counselors.

Figure 1. Section 86.36 of Title IX of The Educational Amendments of 1972.

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